Chapter 6
The Role of AI in Improving Interaction With Cultural Heritage: An Overview

Mario Casillo
University of Salerno, Italy

Angelo Lorusso
University of Salerno, Italy

Francesco Colace
https://orcid.org/0000-0003-2798-5834
University of Salerno, Italy

Domenico Santaniello
https://orcid.org/0000-0002-5783-1847
University of Salerno, Italy

Brij B. Gupta
Asia University, Taichung, Taiwan & Lebanese American University, Beirut, Lebanon

Carmine Valentino
University of Salerno, Italy

ABSTRACT

Over the years, artificial intelligence techniques have been applied in several application fields, exploiting data to execute different tasks and achieve disparate objectives. Therefore, the cultural heritage field can utilise AI techniques to improve the interaction between visitors and cultural assets. Then, this work aims to present the background related to the principal AI techniques and provides an overview of the literature aimed at improving the user cultural experience. This overview focuses on AI integration with tools aimed to enhance the interaction among visitors and cultural sites, such as recommender systems, context-aware recommender systems, and chatbots. Finally, the most common measure used for estimating the accuracy of the AI methodologies will be introduced.

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INTRODUCTION

Artificial Intelligence (AI) (Brasse et al., 2023) refers to the machine's or system's ability to simulate human intelligence and indicates a complex discipline in continuous evolution. In literature, two distinct objectives exist:

- the creation of a Strong AI able to reproduce the principal human intelligence characteristics,
- the development of a Weak AI that requires the resolution of specific problems related to an application area.

The first objective represents only a theoretical one, instead, the second has several applications, such as education, e-commerce, healthcare, chatbots, travel, transport, etc (Brasse et al., 2023). Moreover, AI includes various methodologies, such as Machine Learning (ML) (Wuest et al., 2016), a computer science field that solves an issue without requiring specific programming. Indeed, ML requires data to learn how to perform a task through experience and, through performance measures, estimate its ability after the learning phase. A subset of ML consists of Deep Learning (DL) (Sarker, 2021; Schmidhuber, 2015) that represents an evolution of ML based on Artificial Neural Networks (ANN).

As mentioned above, Artificial Intelligence development involves his employment in various application fields. In particular, Cultural Heritage takes advantage of novel methodologies for improving the interaction between visitors and cultural assets (Fiorucci et al., 2020) and making available novel approaches to make visits a unique experience for the user through personalisation techniques. For the personalisation techniques employment, AI, in particular ML, cooperates with Recommender Systems (RSs), analysis and filtering tools, able to identify users' preferences and elaborate appropriate suggestions (Bobadilla et al., 2013; Ricci et al., 2015). The RSs integration with ML techniques allows systems to deal with the Big Data problem, where the Big Data term defines a data set described by the enormous quantity, variety, and velocity (Philip Chen & Zhang, 2014). Thus, like Machine Learning techniques, Recommender Systems also feed through data to process personalised suggestions about each user.

RSs work on three elements: users that require support, items that have to be suggested, and transactions, aka an interaction between the user and the system, usually represented as the rating (or utility function) (Ricci et al., 2015). Recommender Systems elaborates suggestions based on several techniques that can be classified into three fundamental groups: Content-Based, Collaborative Filtering, and Hybrid (Ricci et al., 2015).

Content-Based techniques aim to create numerical vectors that translate users' preferences and elaborate suggestions through similarity measures. In this technique, Information Retrieval represents a fundamental resource for generating the profiles (Ricci et al., 2015).

Instead, Collaborative Filtering RSs (Bobadilla et al., 2013) generate suggestions elaborating interactions among users and the system and are divided into Memory-Based and Model-Based. Memory-Based techniques consist of identifying groups of users (User-Based), items (Item-Based), or both (User-Item-Based). The idea behind the Memory-Based User-Based RSs takes advantage of the similarity among users having analogous preferences. Memory-Based Item-Based RSs suggest users items like ones that users enjoyed. Instead, User-Item-Based Memory-Based RSs exploit both approaches to improve recommendations. In this field, Machine Learning employment techniques can improve the clustering creation through K-Nearest Neighbor or K-Means algorithms. In the first case, the appropriate suggestions classification takes advantage of similar users or items to identify the proper recommendation. Instead,